Water Resources Data, Iowa, Water Year 2004

Volume 1—Surface Water and Precipitation

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Introduction

The Water Resources Discipline of the U.S. Geological Survey, in cooperation with State, county, municipal, and other Federal agencies, obtains a large amount of data pertaining to the water resources of Iowa each water year. These data, accumulated during many water years, constitute a valuable data base for developing an improved understanding of the water resources of the State. To make this data readily available to interested parties outside of the Geological Survey, the data is published annually in this report series entitled "Water Resources Data - Iowa" as part of the National Water Data System.

Water-resources data for water year 2004 for Iowa consists of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground water. This volume of the report contains stage or discharge records for 134 gaging stations; stage records for 9 lakes and reservoirs; water-quality records for 4 gaging stations; sediment records for 11 gaging stations; peak-flow data for 90 crest-stage partial-record stations; and precipitation data collected at 6 gaging stations and 1 precipitation site. Additional water data were collected at various sites not included in the systematic data-collection program and are published as miscellaneous measurements and analyses.

Records of discharge or stage of streams, and contents or stage of lakes and reservoirs were first published in a series of U.S. Geological Survey water-supply papers entitled "Surface Water Supply of the United States." Through September 30, 1960, these water-supply papers were published in an annual series; during 1961–65 and 1966–70, they were published in 5-year series. Records of chemical quality, water temperatures, and suspended sediment were published from 1941 to 1970 in an annual series of water-supply papers entitled "Quality of Surface Waters of the United States." Records of ground-water levels were published from 1935 to 1974 in a series of water-supply papers entitled "Ground-Water Levels in the United States." Water-supply papers may be consulted in the libraries of the principal cities in the United States, or they may be purchased from Books and Open-File Reports Section, Federal Center, Box 25425, Denver, Colorado 80225.

For water years 1961 through 1970, streamflow data were released by the Geological Survey in annual reports on a State-boundary basis. Water-quality records for water years 1964 through 1970 were similarly released either in separate reports or in conjunction with streamflow records.

Beginning with the 1971 water year, water data for streamflow, water quality, and ground water are published in official U.S. Geological Survey reports on a State-boundary basis. These official reports carry an identification number consisting of the two-letter State postal abbreviation, the last two digits of the water year, and the volume number. For example, this report is identified as "U.S. Geological Survey Water-Data Report IA-04-1." These water-data reports are for sale by the National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia 22161.

Additional information for ordering specific reports may be obtained from the Center Director at the address given on the back of the title page or by telephone, (319) 337-4191.

Cooperation

The U.S. Geological Survey has had cooperative agreements with various governmental agencies in the State of Iowa for the systematic collection of streamflow records since 1914, ground-water levels since 1935, and water-quality records since 1943. During water year 2004, the agencies that assisted through cooperative agreements were:

Iowa Department of Natural Resources–Geological Survey
Iowa Department of Transportation

Iowa Highway Research Board

Iowa State University
University of Iowa, Institute of Hydraulic Research
University of Iowa, Hygienic Laboratory
University of Iowa

Appanoose County Board of Supervisors
Buchanan County Emergency Management
Davis County Board of Supervisors
Fremont County Board of Supervisors
Lake Panorama Association
Van Buren County Board of Supervisors

City of Ames
City of Bettendorf
City of Burlington
City of Cedar Falls
City of Cedar Rapids
City of Charles City
City of Clear Lake
City of Clinton
City of Coralville
City of Davenport
City of Decorah Water Department
City of Des Moines
City of Des Moines Water Works
City of Fort Dodge
City of Iowa City
City of Marshalltown
City of Milford
City of Sioux City
City of Waterloo Water Pollution Control Plant
City of Waverly
City of West Des Moines

Services and financial assistance were provided by the U.S. Army Corps of Engineers in collecting streamflow records for 73 stream-gaging stations. Data were provided by NOAA-National Weather Service, U.S. Department of Commerce, and the U.S. Geological Survey Biological Resources Discipline. The following organizations aided in collecting records and are acknowledged in the respective station descriptions:

Milford Municipal Utilities
Central Iowa Energy Cooperative
Ameren-Union Electric Company

Summary of Hydrologic Conditions

Precipitation

For water year 2004 (October 1, 2003 to September 30, 2004) climatological conditions were well above normal. Recorded precipitation for the year ranged from +6.66 inches above normal in the Northeast Iowa Climatological District to -1.39 inches less than normal in the Southeast Iowa Climatological District (fig. 1). Precipitation recorded for the State averaged 36.80 inches, which was +2.72 inches above normal or 108 percent of the normal 34.08 inches for 1971-00 (table 1). Overall, water year 2004

was the 22nd wettest and 62nd warmest for 131 years of record. [In this summary of hydrologic conditions, all data and statistics pertaining to precipitation and temperature in Iowa were provided by Harry Hillaker, State Climatologist, Iowa Department of Agriculture and Land Stewardship, (oral and written commun., 2004).]

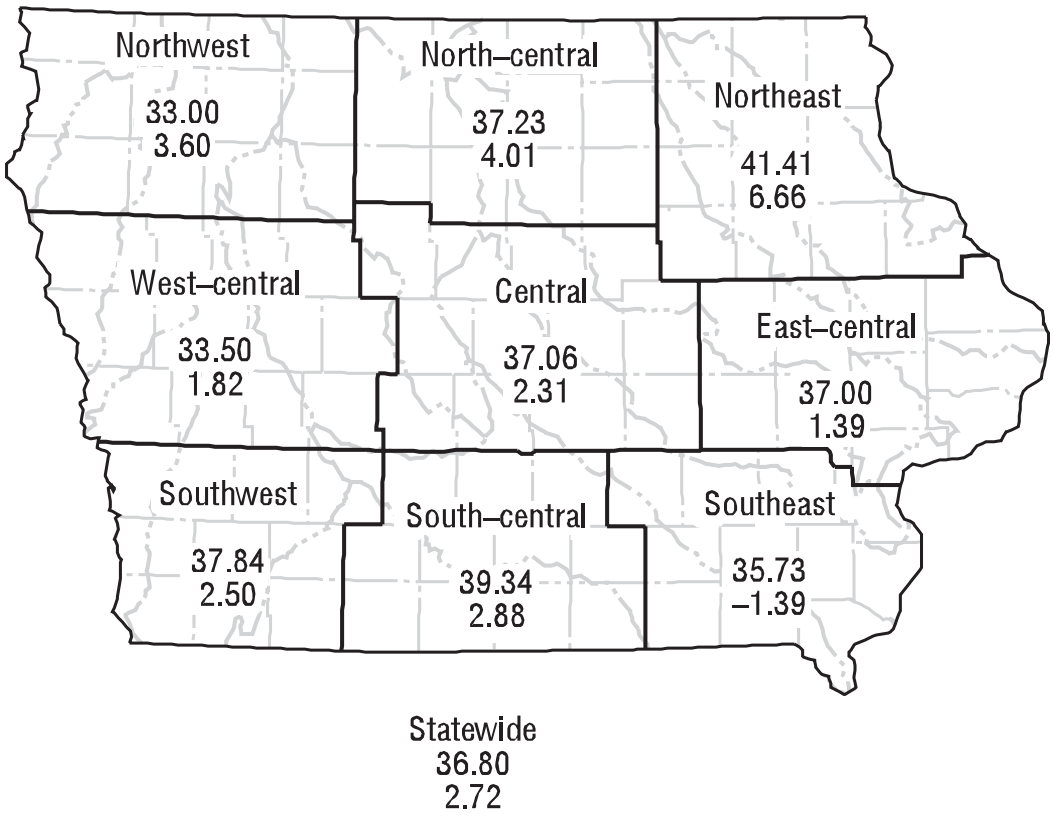

Figure 1. Water year 2004 precipitation record for the National Weather Service's designated Climatological Districts [upper value: average precipitation for the water year, in inches; lower value: deviation from long-term average (1971-2000), in inches;] source: Harry Hillaker, State Climatologist, Iowa Department of Agriculture and Land Stewardship, written commun., 2004).

Table 1. Monthly and annual precipitation during the 2004 water year as a percentage of normal precipitation (1971-2000).
[Source: Harry Hillaker, State Climatologist, Iowa Department of Agriculture and Land Stewardship, written commun., 2004]

National Weather Service Climatological District	2003			2004									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Annual
Northwest	30	48	123	129	163	142	83	164	48	111	58	319	112
North-central	24	109	77	69	160	172	74	227	76	119	81	135	112
Northeast	41	204	78	49	138	203	47	273	113	130	84	33	119
West-central	40	130	94	168	156	195	72	164	100	79	68	99	106
Central	41	225	98	97	156	167	65	180	66	81	126	49	107
East-central	54	188	127	71	105	189	39	192	85	81	114	20	104
Southwest	35	218	107	168	103	197	38	184	63	109	109	45	107
South-central	44	186	108	135	93	164	39	163	77	93	200	29	108
Southeast	46	110	177	96	66	153	46	128	65	89	178	23	96
Statewide	40	161	112	105	123	176	57	186	78	99	110	80	108

Surface water

Streamflow

The water year 2004 runoff at Cedar Rapids was 3,812,000 acre-feet, which is 1,074,000 acre-feet more than the mean annual runoff for the period of record, 2,738,000 acre-feet. The water year 2004 runoff at Fort Dodge was 1,205,000 acre-feet, which is 74,000 acre-feet less than the mean for the period of record, 1,279,000 acre-feet. The water year 2004 runoff at Hamburg was 984,000 acre-feet, which is 76,700 acre-feet more than the mean for the period of record, 907,300 acre-feet. The annual period-of-record runoffs at the index stations are shown in figure 2.

The locations of the active continuous-record gaging stations and crest-stage gaging stations for water year 2004 are shown in figure 3.

Suspended Sediment

Daily suspended-sediment discharge data (hereafter referred to as sediment discharge) were collected at 11 streamflow-gaging stations in Iowa during the 2004 water year. Four stations have 25 years or more of record: 05389500 Mississippi River at McGregor, 05465500 Iowa River at Wapello, 05474000 Skunk River at Augusta, and 05481650 Des Moines River near Saylorville; two stations on the Missouri River have 15 years or more of record: 06486000 Missouri River at Sioux City, Nebraska and 06807000 Missouri River at Nebraska City, Nebraska; one station in northeast Iowa has 13 years of record: 05389400 Bloody Run Creek near Marquette; one station in east-central Iowa has 10 years of record; 05418500 Maquoketa River near Maquoketa; three stations in central Iowa have 9 years of record: 05471040 Squaw Creek near Colfax, 05487540 Walnut Creek near Prairie City, and 05487550 Walnut Creek near Vandalia. The locations of active sediment and surface water-quality stations are shown in figure 4.

The peak daily sediment discharge on 8 of 11 stations occurred between May 20-30, after significant rain events.

Mississippi River at McGregor, which has most of its drainage basin in Minnesota and Wisconsin, had an annual sediment discharge of 1.21 million tons, which was 75.4 percent of the average mean sediment discharge shown in figure 5.

The sediment station on the Des Moines River near Saylorville in central Iowa is downstream from a major flood-control reservoir (Saylorville Reservoir). The annual sediment discharge at this station for water year 2004 was 75.5 thousand tons. This represents 33.4 percent of the 27-year mean sediment discharge. The mean annual sediment discharge since dam completion is 226,000 tons (fig. 5).

Sediment discharges for Iowa River at Wapello and Skunk River at Augusta in southeast Iowa were indicative of the below-normal precipitation in central and eastern Iowa. The Iowa River basin drainage includes parts of the Southeast, East-central, Central, Northeast, and North-central Climatological Districts, and drains an area nearly three times as large as the Skunk Basin. These districts had about 108 percent of normal precipitation. Wapello had an annual sediment discharge of 2.11 million tons and represents 82.7 percent of the 26-year mean sediment discharge of 2.55 million tons (fig. 5). The headwaters of the Skunk River basin are in central Iowa and flow is southeasterly to the confluence with the Mississippi River. A substantial part of the drainage basin is located in the Southeast Climatological District. The annual precipitation for this district was 108 percent of normal for water year 2004. The 2004 annual sediment discharge for Skunk River at Augusta was 1.74 million tons and represents 66.3 percent of the 29-year mean sediment discharge of 2.63 million tons (fig. 5).

The 2004 annual sediment discharge for the small drainage basin in northeast Iowa; Bloody Run Creek near Marquette (05489400) was 12.9 thousand tons, which is the 2nd highest sediment discharge for period of record, with the largest percentage of total yearly runoff occurring in May at 89 percent. The annual runoff was 300 percent of the 13-year mean sediment discharge of 4,253 tons. The annual sediment discharge for the station in east-central Iowa, Maquoketa River near Maquoketa (05418500), had an annual sediment discharge of 710 thousand tons and was the 6th lowest sediment discharge in the 10-year record. Fifty-three percent of the yearly total was measured in May.

The annual sediment discharge for the three stations located in central Iowa with less than approximately 20 square miles of drainage reflect precipitation patterns on small drainage basins. The annual sediment discharge for Squaw Creek near Colfax (05471040) was 5,640 tons. Thirty-two percent of Squaw Creek's annual sediment discharge was measured in July. The annual sediment discharge for Walnut Creek near Prairie City (05487540) was 475.6 tons, while Walnut Creek near Vandalia (05487550) was 4,330 tons of annual sediment discharge. Vandalia has a drainage area approximately three times the size of Prairie City, but had about 9 times the amount of sediment discharge of Prairie City.

The two Missouri River stations (fig. 5) have large drainage areas, which the sediment discharges reflect. The annual sediment discharge at Sioux City was 4.35 million tons, which was 37 percent of the 15-year mean of 11.8 million tons. The annual sediment discharge at Nebraska City was 16.3 million tons, which was 55 percent of the 18-year mean of 29.8 million tons.

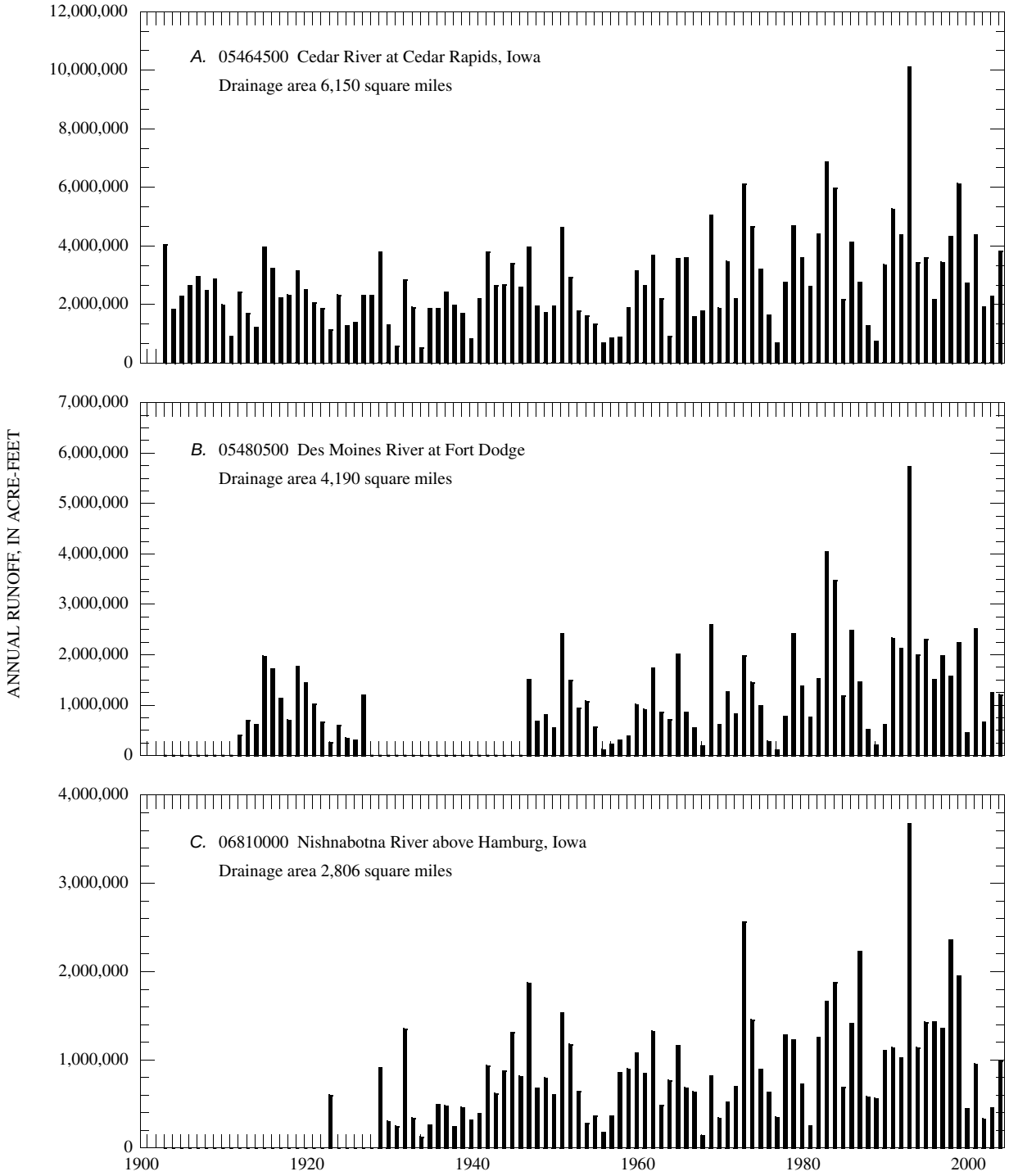

Figure 2. Annual runoff for period of record at index stations.

Water Quality

Surface-water-quality data was collected in Iowa during water year 2004 at two National Stream-Quality Accounting Network (NASQAN) stations. The NASQAN stations in Iowa are the Mississippi River at Clinton (station number 05420500) and

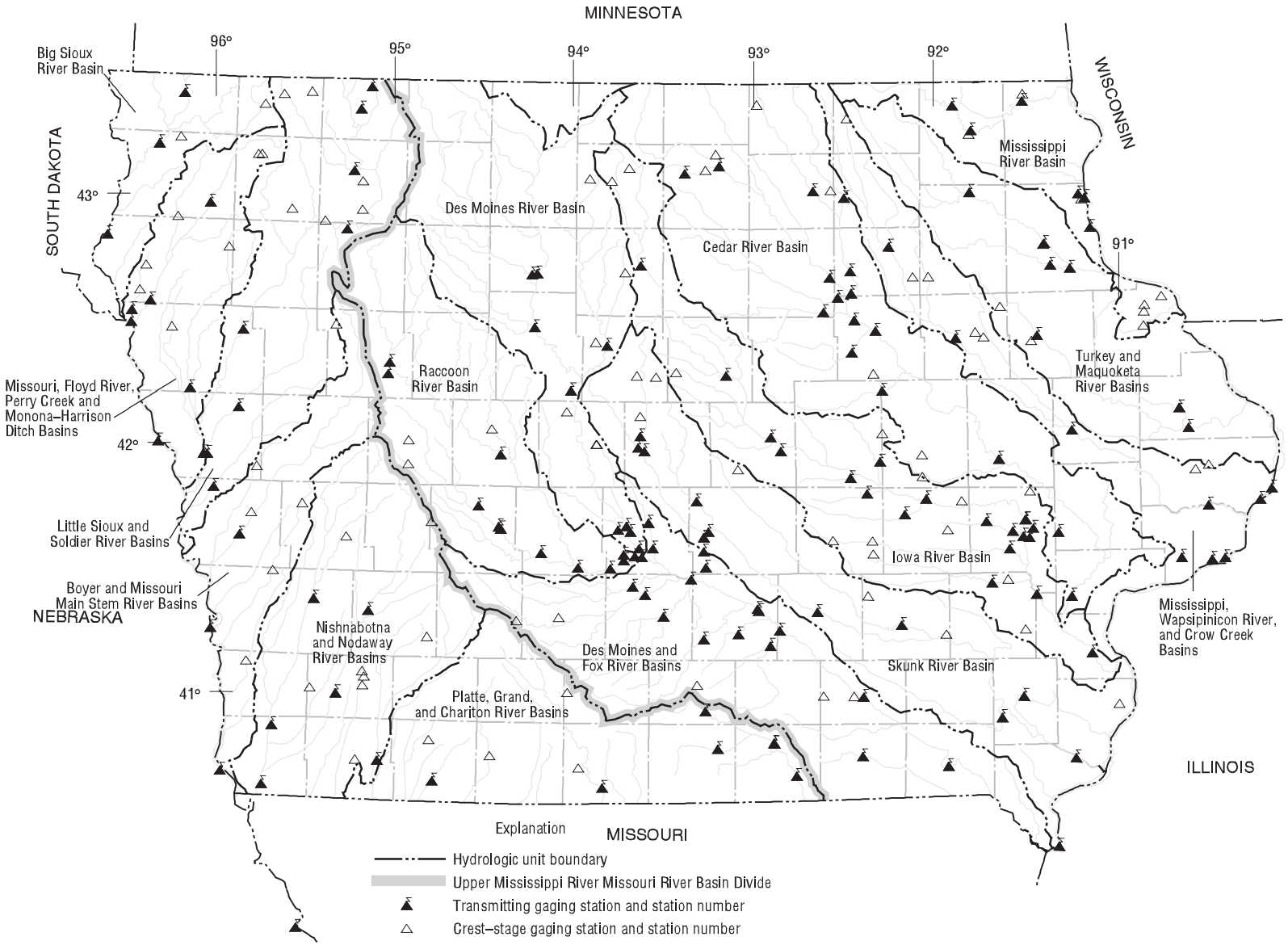

Figure 3. Location of continuous-record and crest-stage gaging stations in Iowa, water year 2004. See drainage-basin maps for gaging-station identification.

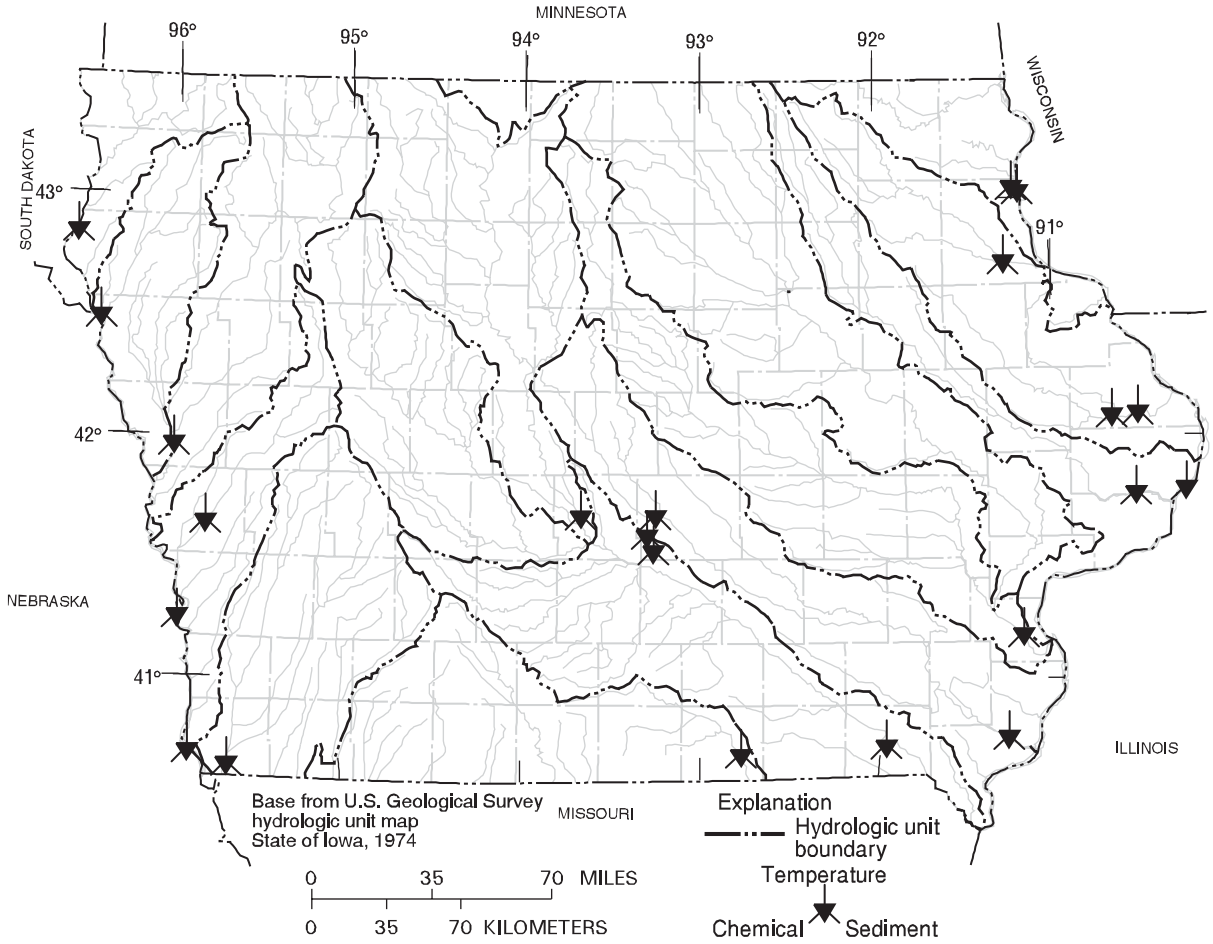

Figure 4. Location of active sediment and surface-water quality stations in Iowa, water year 2004.

Missouri River at Omaha(06610000). The combined drainage area of the two stations is approximately 408,000 sq.miles. Land use throughout the two drainage basins is primarily agricultural. Fifteen water samples were collected at Missouri River at Omaha, and thirteen water samples were collected at Mississippi River at Clinton during the 2004 water year. Nearly all the samples collected at the two stations contained detectable concentrations of agricultural chemicals. Dissolved nitrite plus nitrate as nitrogen (hereafter referred to as nitrate) were common during the 2004 water year, with all samples containing concentrations greater than the detection level of 0.05 mg/L (milligrams per liter). Nitrate concentrations at Clinton ranged from <.06 mg/L on October 20 to 3.39 mg/L, on July 7. Nitrate concentrations at Omaha ranged from 0.16 mg/L on September 3, to 2.40 mg/L, on May 25. Nitrate concentrations in water samples did not exceed 10 mg/L, which is the U.S. Environmental Protection Agency (USEPA), Maximum Contaminate Level (MCL) for public drinking water (USEPA), 1990 Maximum contaminant levels, subpart B of part 141, National primary drinking water regulations: U.S.Code of Federal Regulations, Title 40, Parts 100 to 149, revised as of July 1, 1990, p.553-677). Pesticide analysis were completed for 28 water samples collected at the two NASQAN stations. Atrazine and metolachlor, two of the most commonly used herbicides in Iowa, were detected throughout the year at both NASQAN stations. Some of the detections of herbicide concentrations were at very low limits and are marked with an "E" code for an estimated value. An “E” code means the compound was detected, but the value is approaching quantifiable limits. Acetochlor was detected Fifteen times at Omaha and Thirteen times at Clinton. The largest herbicide concentration was 4.81 ug/L (micrograms per liter) of atrazine in the water sample collected from the Mississippi River on May 26. The largest overall concentration of acetochlor, alachlor, atrazine, cyanazine, and metolachlor in a single event was also at the Mississippi River on May 26. This water sample had 2.80 ug/L of acetochlor, 0.048 ug/L of alachlor, 4.81 ug/L of atrazine, <0.018 ug/L of cyanazine, and 1.21 ug/L of metolachlor. The only herbicide that exceeded USEPA MCL's (USEPA,1992, Fact sheet: EPA 570/9-91-012FS, December 1992) was Atrazine at both the Mississippi River and the Missouri

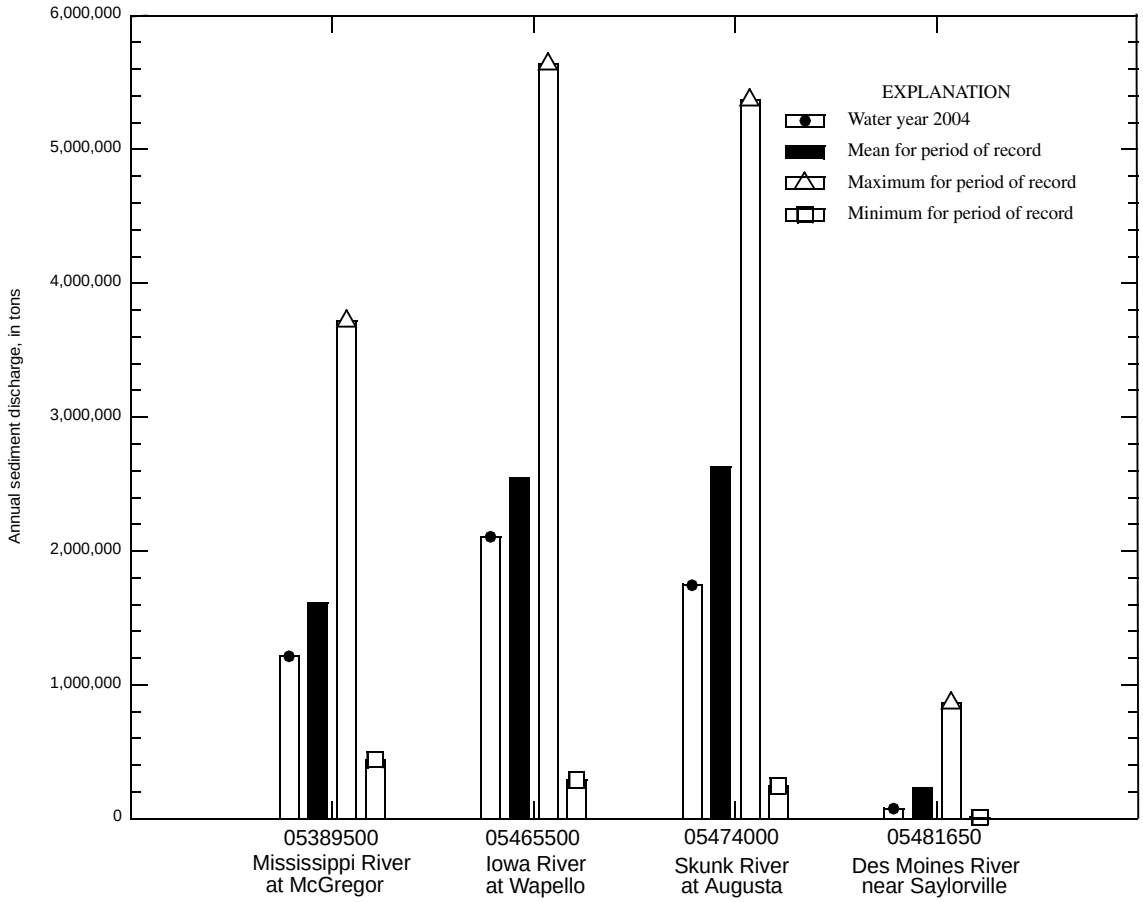

Figure 5. Annual sediment discharge statistics at four long-term streamflow-gaging stations, water year 2004

River site. The USEPA MCL for Atrazine is 3.0 mg/L. The Mississippi River at Clinton had Atrazine above the MCL on May 26, with a value of 4.81 ug/L. The Missouri River at Omaha had Atrazine above the MCL on both May 25, with a value of 3.43 ug/L and June 18, with a value of 3.44 ug/L Herbicide concentrations were generally larger in samples collected during May, June, and July, than in samples collected at other times during 2004 water year. Water samples collected in October through February had the lowest overall concentrations of the five herbicides during the 2004 water year.

Downstream Order and Station Number

Since October 1, 1950, hydrologic-station records in USGS reports have been listed in order of downstream direction along the main stream. All stations on a tributary entering upstream from a main-stream station are listed before that station. A station on a tributary entering between two main-stream stations is listed between those stations. A similar order is followed in listing stations on first rank, second rank, and other ranks of tributaries. The rank of any tributary on which a station is located with respect to the stream to which it is immediately tributary is indicated by an indention in that list of stations in the front of this report. Each indentation represents one rank. This downstream order and system of indentation indicates which stations are on tributaries between any two stations and the rank of the tributary on which each station is located.

As an added means of identification, each hydrologic station and partial-record station has been assigned a station number. These station numbers are in the same downstream order used in this report. In assigning a station number, no distinction is made between partial-record stations and other stations; therefore, the station number for a partial-record station indicates downstream-order position in a list composed of both types of stations. Gaps are consecutive. The complete 8-digit (or 10-digit) number for each station such as 05454500, which appears just to the left of the station name, includes a 2-digit part number “05” plus the 6-digit (or 8-digit) downstream order number “454500.” In areas of high station density, an additional two digits may be added to the station identification number to yield a 10-digit number. The stations are numbered in downstream order as described above between stations of consecutive 8-digit numbers.